STRUCTURAL AND ELECTRIC PROPERTIES OF NANOSTRUCTURED SPINEL FERRITES OBTAINED BY AUTO-COMBUSTION METHOD

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ABSTRACT

The $NiFe_2O_4$ (NiF), $ZnFe_2O_4$ (ZnF) and $CoFe_2O_4$ (CoF) ferrites were prepared by auto-combustion method. Method involves the preparation of aqueous solution containing corresponding metal nitrates and organic compound - citric acid. Metal nitrates acting as oxidants were also used as cation sources, whereas an organic compound was employed as fuel. In the next step dried gel from achieved solution were obtained which was directly transformed into nanosized oxide mixture after temperature initiated oxidation-reduction reaction. Finally obtained oxide mixtures were calcinated at 800 ^oC for ZnF and CoF and at 1000 ^oC for NiF.

The morphology of combustion reaction products were investigated by scanning electron microscopy (SEM). The structural evolution of spinel ferrites and its crystallite sizes at different process stages are investigated by X-Ray diffraction and Fourier transform infrared techniques (FT-IR). The X-ray diffraction patterns after calcination confirm the single-phase spinel structure for the synthesized ferrites. The average crystallite sizes for different compounds were found to be ranging from 33 to 40 nm. The FT-IR measurements show two fundamental absorption bands which are assigned to the vibration of octahedral and tetrahedral complexes characteristic to the structure of spinel. Powder surface area was measured using the multi point Brunauer-Emmet-Teller method (BET). BET results shows, that after calcination sub-micrometer sized primary particles have been agglomered into larger secondary particles. Atomic force microscopy (AFM) was used to study particle dimensions. AFM images reveal particles in the nanosize range (15-60 nm). Room temperature electrical resistivity measurements of the spinel ferrites were measured by conventional two probe method.